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(12) # EUROPEAN PATENT SPECIFICATION

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Description

The present invention relates to a femoral hip prosthesis, and more particularly to a femoral hip stem component.

Hip arthroplasty procedure includes anesthesia and patient placement on a table in proper orientation. The patient's body is then stabilized, scrubbed, prepared and draped. An incision is made and the subcutaneous tissue is divided. Appropriate soft tissue is excised and/or divided for exposure and dislocation of the hip. After the femoral head is dislocated from its associated acetabulum, the head is rotated for better exposure. A femoral neck osteotomy is then performed wherein the head and neck are cut away from the femur shaft. Next, the intermedullary canal is prepared to accommodate the hip stem component of the prosthesis and, ultimately, the stem is anchored within the intermedullary canal.

Prior to the present invention, numerous femoral inserts have been proposed for use in hip joint prostheses. Generally, each includes a polished spherical head or capitulum mounted upon a stem, which is inserted into the intermedullary canal of the femur. Often the inserts are cemented within the canal to hold them fast against the applied forces and loads. Such inserts are described, for example, in U.S. Patents 3,102,536, 3,320,951, 3,818,512, 3,874,003, 3,875,593, 3,965,490, 4,012,796 4,080,666, and EP—A—0038908.

The characteristics of the spacing or interface between the exterior surface of the femoral stem and the interior contour of the prepared cavity in the intermedullary canal play an important role in properly anchoring the insert to the femoral bone. A stem of sufficient length has long been recognized as desirable since it provides increased surface area for cementing within the canal and increased resistance to rotation. However, long stems require large intermedullary cavities, particularly at the calcar leading into the canal, since the overall surface thereof makes it impossible for the insert to pass into the canal without a significantly oversized entranceway. Such cavities result in large gaps or voids between the outside surface of the inserted stem and the inside surface of the cavity. Heretofore, a glove fit between a femoral stem and the intermedullary cavity together with superior anchoring of the stem and resistance to rotation have been considered difficult to achieve.

Accordingly, an object of the present invention is a femoral hip prosthesis having a stem component that forms a glove fit when inserted into the intermedullary canal of a femur, the stem being properly anchored in place and having significant resistance to rotation.

As disclosed in EP—A—0038908, a femoral hip prosthesis comprises a stem component with an anterior face, a posterior face, a lateral face and a medial face, the stem having a proximal portion and a substantially longer distal portion. The stem has a slight posterior bow along its length. According to the invention, the proximal portion has a twist of from about 5 to 15°, the twist extending in a direction from the anterior to the posterior face of the stem through the medial face.

Preferably, the length of the distal portion is from about 2 to 3 times that of the proximal portion, as measured along the medial face, and the twist generally commences at the boundary of the distal and proximal portions. Moreover, the twist preferably extends throughout the proximal portion and is about 9°. The exterior surface of the proximal portion preferably includes a porous coating to stimulate ingrowth of bone.

The proximal portion of the stem may be generally equally divided into proximal, central and distal segments, with a lateral flare provided on the distal segment for wedge-engaging action with the femoral bone when the stem is inserted therein. A neck extends from the proximal segment of the proximal portion of the stem, the neck having an axis at an angle of about 45° to the general orientation of the stem. Preferably, the neck is anteverted at the angle of from about 5 to 15°, and a capitulum may be secured to the neck by a Morse fit.

Novel features and advantages of the present invention in addition to those mentioned above will become apparent to those skilled in the art from a reading of the following detailed description in conjunction with the accompanying drawing wherein:

Figure 1 is a front elevational or antierior view of a left femoral hip prosthesis, according to the present invention;

Figure 2 is a top plan view of the prosthesis shown in Figure 1;

Figure 3 is a right side elevational or lateral view of the prosthesis shown in Figure 1;

Figure 4 is a rear elevational or posterior view of the prosthesis shown in Figure 1;

Figure 5 is a left side elevational or medial view of the prosthesis shown in Figure 1;

Figure 6 is a bottom plan view of the prosthesis shown in Figure 1;

Figure 7 is an exploded view of the prosthesis shown in Figure 1 with the capitulum shown in section;

Figure 8 is a bottom plan view of the capitulum;

Figure 9 is a sectional view taken along line 9—9 of Figure 1;

Figure 10 is a sectional view taken along line 10—10 of Figure 1;

Figure 11 is a sectional view taken along line 11—11 of Figure 1; and

Figure 12 is a sectional view taken along line 12—12 of Figure 1.

Referring in more particularity to the drawing, a femoral hip prosthesis 10 includes a stem component 12 having a neck 14 to which a capitulum 16 is secured. Figures 1—6 illustrate a left hip prosthesis having an anterior face (Figure 1), a posterior face (Figure 4), a lateral face (Figure 3) and a medial face (Figure 5). As explained more fully below, the stem 12 tightly fits within a

prepared intermedullary cavity 18 in the left femur or femoral bone 20. The fit of stem 12 within cavity 18 is glove-like without any void or gap therebetween.

The stem 12 is generally divided into a proximal portion 22 and a substantially longer distal portion 26. The length of the distal portion 26 is preferably from about 2 to 3 times the length of the proximal portion 22 as measured along the medial face (Figure 5). As shown best in Figures 3 and 5, stem 12 has a slight posterior bow 28 along its length. The posterior bow 28 may be a curve having a radius of about 16 inches, for example, and aids in securing the stem 12 to femur 20 while preventing rotation relative to the femoral bone 20.

The proximal portion 22 includes a slight twist which generally commences at the boundary between distal portion 26 and proximal portion 22 and continues in an upward direction to the shoulder 30 forming the upper boundary of proximal portion 22. This total twist of generally from about 5 to 15°, preferably from about 7 to 12° and especially about 9°, in proximal portion 22 extends in a direction from the anterior face to the posterior face of stem 12 through the medial face thereof.

This is best shown in the sectional views of Figures 9—12 wherein it can be seen that distal portion 26 has no twist. Figure 1 together with the sectional views of Figures 9—12 show that the horizontal Y and Z axes cross each other at 90°, and that the point of intersection forms the vertical axis X. Utilizing these coordinates, it is readily apparent from Figures 9 and 10 that distal portion 26 of stem 12 is without twist. However, Figure 11 clearly shows that the twist has commenced in the proximal portion 22 amounting to angle *a* of about 4° at that elevation. Continuing, the upper extreme of proximal portion 22 exhibits the especially preferred total twist angle *b* of about 9°, and such is shown in Figure 12.

The proximal portion 22 of stem 12 may be generally equally divided into a proximal segment 32, a central segment 34 and a distal segment 36. For reasons explained more fully below, distal segment 36 includes a flare 38 on the lateral side thereof. When stem 12 is inserted into femur 20, flare 38 wedgingly engages the adjacent bone to thereby load and stress the bone, which promotes bone growth into and around prosthesis 10. In this regard, the entire outside surface of proximal portion 22 includes a porous coating 40 for the ingrowth of bone and tissue.

As shown best in Figures 1 and 4, neck 14 of prosthesis 10 is at an angle *A* of about 45° to the general orientation of stem 12. The neck 14 has a tapered free end portion 42 which cooperates with a tapered internal socket 44 in the capitulum 16. The tapering characteristics of end portion 42 and socket 44 are such that a Morse fit results when the capitulum 16 is secured onto the neck 14. As is well known, the capitulum 16 is in the form of a polished spherical element which articulates with the natural acetabulum, or an acetabular prosthesis if the natural acetabulum has been replaced.

Neck 14 and its associated capitulum 16 are anteverted at an angle *B*, generally of from about 5 to 15° and preferably from about 9 to 15°. As shown in Figures 2 and 3, this anteversion is about 9°; as such, capitulum 16 is angled slightly toward the anterior by about 9°. Such anteversion places capitulum 16 in the best possible position for articulation with the natural acetabulum or acetabular prosthesis.

Femoral hip prosthesis 10 is implanted within the femur 20 following femoral neck osteotomy and proper formation of the intramedullary cavity 18 into which stem 12 of the prosthesis 10 is to be inserted. In forming the intramedullary cavity 18, a portion of the cancellous tissue near the end of the femur 20 initially is cut away with an appropriate cutting tool (not shown). Following such removal, a rasp (not shown) having the same general shape as stem 12 is driven into the intramedullary canal of femur 20. The rasp is then withdrawn from the femur 20 and the stem 12 introduced into the thus formed intramedullary cavity 18. Stem 12 passes into intramedullary cavity 18 without violating or interrupting the newly formed contour shaped by the rasp. The posterior bow 28 together with the twist in the proximal portion 22 enables such insertion of the stem into intramedullary cavity 18 and results in a glove fit substantially free of gaps or voids between the exterior surface of the stem 12 and the interior contour of the prepared cavity 18.

Porous coating 40 on proximal portion 22 stimulates ingrowth of bone, and the lateral flare 38 accelerates this anchoring process. Since tensile loading is greatest at the lateral surface of proximal portion 22, lateral flare 38 increases the surface area at that location to load and stress the adjacent bone and thereby promote ingrowth. Additionally, the wedge engaging action of the lateral flare 38 against the femoral bone 20 significantly contributes to the anchoring of the stem 12 within the intramedullary cavity 18, and bone cement is not needed.

With prosthesis 10 in two pieces comprising stem 12 and capitulum 16, multiple neck lengths can be obtained with each stem 12 by using capitulums 16 with different internal sockets 44. For example, when a long neck length is desired, the internal socket 44 in the capitulum 16 may be short, and with a long internal socket 44 a shorter neck length is achieved with the same stem 12. Both stem 12 and capitulum 16 may be fabricated of, for example, cobalt/chromium/molybdenum or titanium by techniques known in the art.

Claims

1. A femoral hip prosthesis (10) comprising a stem component (12) with an anterior face, a posterior face, a lateral face and a medial face, the stem (12) having a proximal portion (22) and a substantially longer distal portion (26) and ex-

hibiting a slight posterior bow (28) along its length, characterized in that the stem (12) also includes a twist of from about 5 to 15° in the proximal portion (22), the twist extending in a direction from the anterior to the posterior face through the medial face.

2. A femoral hip prosthesis (10) as in claim 1 wherein the length of the distal portion (26) is from about 2 to 3 times the length of the proximal portion (22) as measured along the medial face.

3. A femoral hip prosthesis (10) as in claim 1 wherein the twist generally commences at the boundary of the distal (26) and proximal (22) portions.

4. A femoral hip prosthesis (10) as in claim 3 wherein the twist extends throughout the proximal portion (22) and is about 9°.

5. A femoral hip prosthesis (10) as in claim 1 wherein the exterior surface of the proximal portion (22) includes a porous coating (40).

6. A femoral hip prosthesis (10) as in claim 1 wherein the proximal portion (22) is generally equally divided into a proximal segment (32), a central segment (34) and a distal segment (36) with a lateral flare (38) on the distal segment (36).

7. A femoral hip prosthesis (10) as in claim 6 including a neck (14) extending from the proximal segment (32), the neck (14) having an axis at an angle of about 45° to the general orientation of the stem (12).

8. A femoral hip prosthesis (10) as in claim 7 wherein the neck (14) is anteverted at an angle of from about 5 to 15°.

9. A femoral hip prosthesis (10) as in claim 8 including a capitulum (16) secured to the neck (14).

10. A femoral hip prosthesis (10) as in claim 9 wherein the capitulum (16) and the neck (14) are secured together by a Morse fit.

Patentansprüche

1. Oberschenkel-Hüftgelenkprothese (10) mit einem Schaftteil (12) mit vorderer Fläche, hinterer Fläche, Seitenfläche und medialer Fläche, wobei der Schaft (12) einen körpernahen Abschnitt (22) und einen wesentlich längeren körperfernen Abschnitt (26) hat und einen leichten rückseitigen Bogen (28) über seine Länge aufweist, dadurch gekennzeichnet, daß der Schaft (12) auch eine Verwindung von ungefähr 5 bis 15° im körpernahen Abschnitt (22) enthält, wobei sich die Verwindung in einer Richtung von der vorderen zur hinteren Fläche durch die mediale Fläche erstreckt.

2. Oberschenkel-Hüftgelenkprothese (10) nach Anspruch 1, wobei die Länge des körperfernen Abschnitts (26) ungefähr 2- bis 3-mal die Länge des körpernahen Abschnitts (22) gemessen längs der medialen Fläche, beträgt.

3. Oberschenkel-Hüftgelenkprothese (10) nach Anspruch 1, wobei die Verwindung im allgemeinen an der Grenze zwischen körperfernem (26) und körpernahem (22) Abschnitt beginnt.

4. Oberschenkel-Häuftgelenkprothese (10) nach Anspruch 3, wobei sich die Verwindung über den gesamten körpernahen Abschnitt (22) erstreckt und ungefähr 9° beträgt.

5. Oberschenkel-Hüftgelenkprothese (10) nach Anspruch 1, wobei die äußere Oberfläche des körpernahen Abschnitts (22) einen porösen überzug (40) enthält.

6. Oberschenkel-Hüftgelenkprothese (10) nach Anspruch 1, wobei der körpernahe Abschnitt (22) im allgemeinen gleich in ein körpernahes Segment (32), ein mittleres Segment (34) und ein körperfernes Segment (36), mit einer seitlichen Ausbauchung (38) am körperfernen Segment (36), unterteilt ist.

7. Oberschenkel-Hüftgelenkprothese (10) nach Anspruch 6, mit einem sich von körpernahen Segment (32) erstreckenden Hals (14), der eine Achse unter einem Winkel von ungefähr 45° zur allgemeinen Ausrichtung des Schaftes (12) hat.

8. Oberschenkel-Hüftgelenkprothese (10) nach Anspruch 7, wobei der Hals (14) unter einem Winkel von ungefähr 5 bis 15° nach vorne geneigt ist.

9. Oberschenkel-Hüftgelenkprothese (10) nach Anspruch 8, mit einem am Hals (14) befestigten Kapitulum (16).

10. Oberschenkel-Hüftgelenkprothese (10) nach Anspruch 9, wobei das Kapitulum (16) und der Hals (14) durch eine Morse-Passung fest miteinander verbunden sind.

Revendications

1. Prothèse fémorale de hanche (10) comprenant une composant (12) formant tige ayant une face antérieure, une face postérieure, une face latérale et une face intermédiaire, la tige (12) ayant une partie proximale (22) et une partie distale (26) substantiellement plus longue et présentant, en longueur, une légère courbure postérieure (28) caractérisée en ce que la tige (12) présente, en outre, une torsion sur environ 5 à 15° affectant la partie proximale (22), la torsion s'étendant dans une direction allant depuis la face antérieure jusqu'à la face postérieure au travers de la face intermédiaire.

2. Prothèse fémorale de hanche (10) selon la revendication 1, dans laquelle la longueur de la partie distale (26) est, approximativement, de 2 à 3 fois la longueur de la partie proximale (22) telle que mesurée le long de la face intermédiaire.

3. Prothèse fémorale de hanche (10) selon la revendication 1, dans laquelle la torsion commence généralement à la frontière entre les portions distale (26) et proximale (22).

4. Prothèse fémorale de hanche (10) selon la revendication 3, dans laquelle la torsion s'étend approximativement sur toute la partie proximale (22) et en ce qu'elle est d'environ de 9°.

5. Prothèse fémorale de hanche (10) selon la revendication 1, dans laquelle la surface extérieure de la partie proximale (22) comporte un revêtement poreux (40).

6. Prothèse fémorale de hanche (10) selon la revendication 1, dans laquelle la partie proximale

(22) est généralement divisée également en un segment proximal (32), un segment central (34) et un segment distal (36) avec un aplatissement latéral (38) sur le segment distal (36).

7. Prothèse fémorale de hanche (10) selon la revendication 6, comportant un col (14) s'étendant à partir du segment proximal (32), le col (14) ayant un axe qui fait un angle d'environ 45° avec l'orientation générale de la tige (12).

8. Prothèse fémorale de hanche (10) selon la revendication 7, dans laquelle le col (14) est antéverti selon un angle d'environ 5 à 15°.

9. Prothèse fémorale de hanche (10) selon la revendication 8, comportant un capitule (16) fixé au col (14).

10. Prothèse fémorale de hanche (10) selon la revendication 9, dans laquelle le capitule (16) et le col (14) sont réunis ensemble par un ajustement de Morse.

Fig. 2.

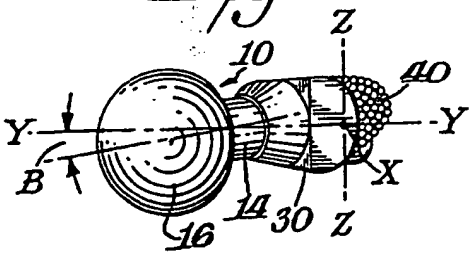

Fig. 1.

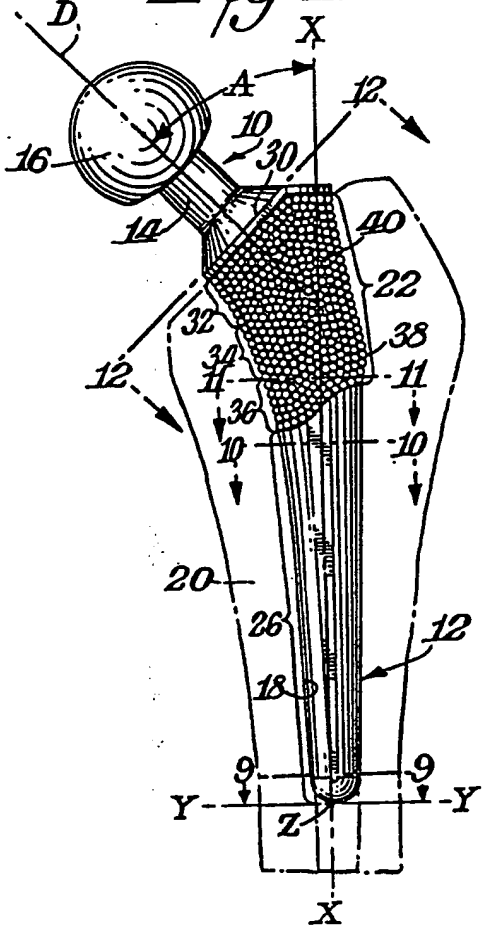

Fig. 3.

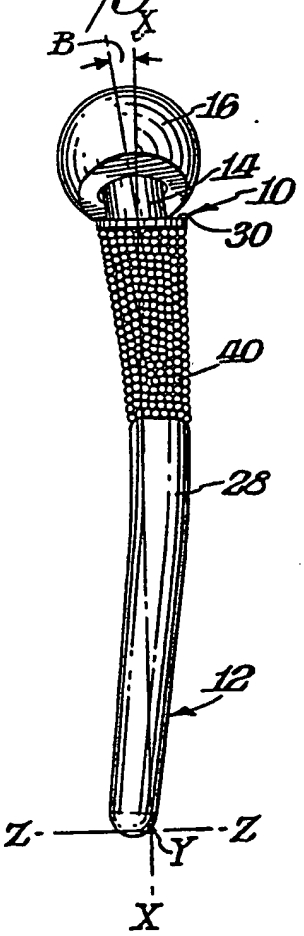

Fig. 4.

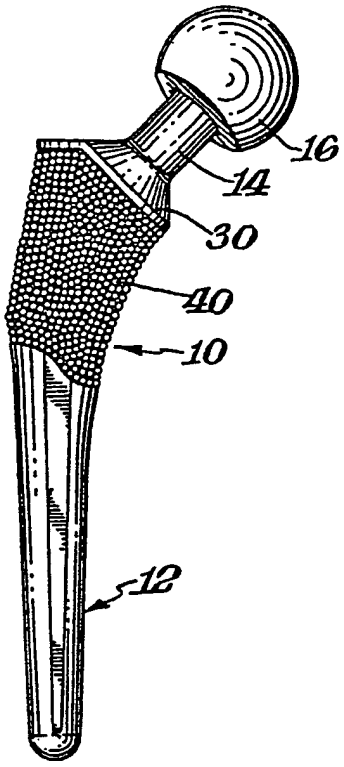

Fig. 5.

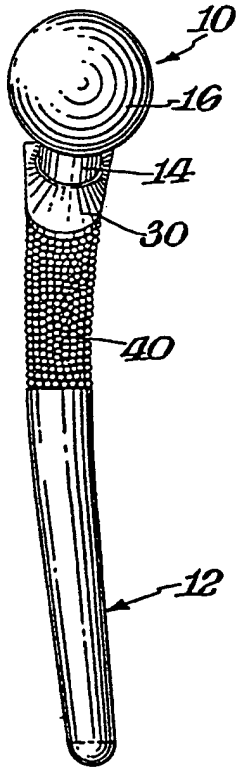

Fig. 6.

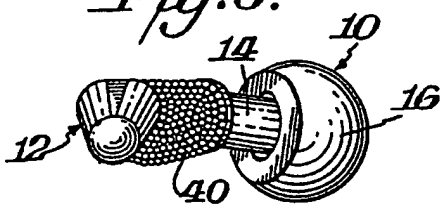

Fig. 7.

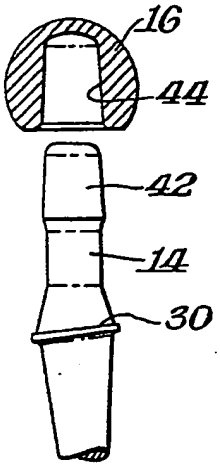

Fig. 8.

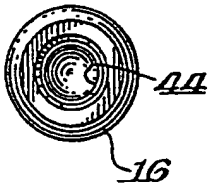

Fig. 12.

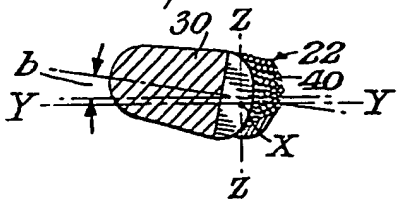

Fig. 11.

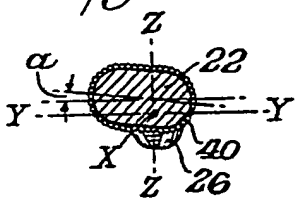

Fig. 10.

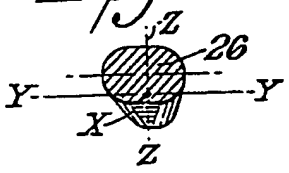

Fig. 9.